Claims

1. Separating mechanism (11'; 12; 12') for conveying and separating elongate parts (2) from a part quantity in a conveying direction (9) extending transversely to their longitudinal extension, with a pick-up region (39'; 41; 41') for a part quantity of elongate parts (2) and a discharge region (51) for elongate parts (2) separated from the part quantity disposed above it, with at least one endlessly circulating, driveable conveyor element (47) extending between the pick-up region (39'; 41; 41') and the discharge region (51), which conveyor element (47) has driver elements (46) disposed one after the other in the conveying direction (9) and extending parallel with one another transversely to the conveying direction (9), wherein each driver element (46) has at least one recessed groove (90) on its external face directed towards the pick-up region (39'; 41; 41') extending in its longitudinal direction and open in the direction towards the pick-up region (39'; 41; 41') with an approximately trapezoidal cross-section for accommodating elongate parts (2) as and when necessary, and a length of the recessed groove (90) corresponds to at least twice the maximum length (32) of the elongate part (2) and the recessed groove (90) is bounded by a groove base (104) and guide surfaces (105) extending at an angle towards one another, and the planes of the two guide surfaces (105) subtend an angle (106) of less than 90°.

2. Separating mechanism according to claim 1, wherein the conveyor element (47) is provided in the form of a conveyor belt guided round at least one drive wheel (57) and at least one pulley block (56), and the driver elements (46) are formed by conveyor belts, in particular are integrally joined thereto.

3. Separating mechanism according to claim 1, wherein the conveyor element (47) is formed by a plurality of mutually separate driver elements (46) which can be displaced relative to one another, and endlessly circulating drive elements (54) are disposed on either side of the conveyor element (47) spaced at a distance apart from one another transversely to the conveying direction (9) of the elongate parts (2), and driver elements (46) extend between the oppositely lying drive elements (54) parallel with one another and separated from one another in the conveying direction (9) of the elongate parts (2) by a spacing gap (99), and every driver element (46) is connected to the drive elements (54) so as to be fixed therewith in displacement.

4. Separating mechanism according to one of claims 1 to 3, wherein the drive elements (54) are formed by endlessly circulating drive chains, comprising chain links (70) articulatingly connected to one another by bolts (69) extending parallel with one another and guided round at least one drive wheel (54) and at least one pulley block (56), and the driver elements (46) extend respectively between two chain links (70) of the drive chains lying symmetrically opposite one another by reference to a longitudinal mid-plane (96) parallel with one another and separated from one another in the conveying direction (9) of the elongate parts (9) by the spacing gap (99), and every driver element (46) is connected to the oppositely lying chain links (70) of the drive chains so as to be fixed in displacement therewith, and longitudinal edges (100) of two driver elements (46) disposed one after the other in the conveying direction (9) extend opposite from one another by reference to an articulation axis (101) between two chain links (70) as well as slightly offset from the articulation axis (101), which longitudinal edges (100) bound the spacing gap (99) which more or less corresponds to the minimum cross-sectional dimension (34) of the elongate part (2) or is smaller than a minimum cross-sectional dimension (34) of the elongate part (2).

5. Separating mechanism according to claim, wherein the longitudinal edges (100) of two driver elements (46) of the conveyor element (47) disposed one after the other are respectively formed by a section with section peaks (168) disposed one after the other in the longitudinal extension of the driver elements (46) alternating with section valleys (169) recessed with respect thereto, and the section peaks (168) of the first driver element (46) project into the section valleys (169) of the other driver element (46) and bound the spacing gap (99).

6. Separating mechanism according to claim 1, wherein a strand of the conveyor element (47) extending between the pick-up region (39‘; 41; 41‘) and the discharge region (51) and directed towards the pick-up region (39‘; 41; 41‘) is divided into a driving portion (85), a separating region (86) and a discharge portion (87) and the driving portion (85) directed towards the pick-up region (39‘; 41; 41‘) is concavely curved, the separating region (86) runs across wide parts in an essentially straight line and is inclined with respect to a horizontal plane (79) and the discharge portion (87) runs across wide parts in an essentially straight line and is parallel with the horizontal plane (79).

7. Separating mechanism according to claim 1, wherein a strand of the conveyor element

(47) extending between the pick-up region (39'; 41; 41') and the discharge region (51) and directed towards the pick-up region (39'; 41; 41') is divided into a driving portion (85), a separating region (86) and a discharge portion (87) and the driving portion (85) runs in the extension of the separating region (86) and across wide parts in an essentially straight line, and the discharge portion (87) runs across wide parts in an essentially straight line and is parallel with the horizontal plane (79).

8. Separating mechanism according to claim 6 or 7, wherein an angle of inclination (88) of the separating region (86) by reference to the horizontal plane (79) is less than 90°.

9. Separating mechanism according to claim 8, wherein the angle of inclination (88) of the separating region (86) by reference to the horizontal plane (79) is between 60° and 85°.

10. Separating mechanism according to claim 6 or 7, wherein an angle (89) subtended between a tangent (T) at the apex point (S) of the concave driving portion (85) and a chute base (49) of an inlet chute (45) or the straight driving portion (85) and a chute base (49) of an inlet chute (45) is less than 90°.

11. Separating mechanism according to claim 10, wherein the angle (89) is between 55° and 80°.

12. Separating mechanism according to one of claims 1 to 10, wherein the pick-up region (41) is formed by an inlet chute (45) of a supply container (44) disposed on a frame (48) of the separating mechanism (12) and bounded by part-regions of the inlet chute (45) and the strand of the conveyor element (47) directed towards it, in particular its driving portion (85).

13. Separating mechanism according to one of claims 1 to 10, wherein the pick-up region (39'; 41; 41') is formed by a concave part-portion (161) of a strand of the conveyor element (47) directed towards it and has a tub-shaped cross-sectional contour.

14. Separating mechanism according to claim 13, wherein, as viewed in the cross-sectional plane, the pick-up region (39'; 41; 41') is essentially formed or bounded by a circle segment, the chord (162) of which intersects the driving portion (85), in particular in the conveying

direction (9) shortly before the inlet start of the separating region (86), or intersects the inlet start of the separating region (86) and extends essentially parallel with or inclined at an angle with respect to the horizontal plane (79), and a center point angle (163) is between 50° and 90°.

15. Separating mechanism according to one of claims 1 to 14, wherein at least one drive wheel (57) and several pulley blocks (56) are respectively rotatably mounted at two oppositely lying vertical side parts (159) of a frame (160) of the separating mechanism (11'; 12') disposed at a distance apart transversely to the conveying direction (9), and an angle (167) subtended by the parallel axes (165) of the pulley blocks and/or the drive wheel (56, 57) extending adjacent to the pick-up region (39', 41'), disposed vertically one above the other and horizontally offset from one another, is less than 90 °, in particular between 30 ° and 60 °, for example 45 °.

16. Separating mechanism according to one of claims 1 to 14, wherein at least one drive wheel (57) and several pulley blocks (56) are respectively rotatably mounted at two oppositely lying vertical side parts (159) of a frame (160) of the separating mechanism (11'; 12') disposed at a distance apart transversely to the conveying direction (9), and a connecting line (166) extending between the parallel axes (165) of the pulley blocks and/or drive wheels (56, 57) adjacent to the pick-up region (39' 41'), disposed vertically one above the other and horizontally offset from one another, and the horizontal plane (79) extend parallel with one another.

17. Separating mechanism according to one of claims 1 to 16, wherein the conveyor element (47) or every drive element (54) is guided along a slide track (65) extending along each side part (52; 159) of the frames (48; 160) between at least the pick-up region (39'; 41; 41') and the discharge region (51) of the conveyor element (47).

18. Separating mechanism according to one of claims 1 to 5, wherein every driver element (46) has an approximately C-shaped cross-section and a base (107) remote from the pick-up region (39'; 41; 41') and two legs (108) extending out from the base (107).

19. Separating mechanism according to claim 18, wherein a free end of the front first leg (108) projects in the conveying direction (9) of the elongate parts (2) alongside a free end of

the rear second leg (108) in the conveying direction (9) of the elongate parts (2).

20. Separating mechanism according to claim 18 or 19, wherein a free end of the front first leg (108) in the conveying direction (9) of the elongate parts (2) is inclined with respect to the groove base (104) and forms a deflector surface (110), and the groove base (104) and the deflector surface (110) subtend an angle.

21. Separating mechanism according to claims 18 to 20, wherein the base (107) forms the groove base (104) and the first and second legs (108) form the mutually facing guide surfaces (105).

22. Separating mechanism according to one of claims 18 to 21, wherein a minimum depth (111) of the recessed groove (90) is at least slightly bigger than a normal distance (112) measured between a surface center of gravity (113) of the individual elongate part (2) lying in the cross-sectional plane and the groove base (104).

23. Separating mechanism according to one of claims 18 to 21, wherein a width (114) of the recessed groove (90) approximately corresponds to the maximum cross-sectional dimension (34) of the individual elongate part (2).

24. Separating mechanism according to claim 1, wherein the angle (106) is between 20° and 30°.

25. System (1) for conveying and separating elongate parts (2), comprising a first inlet conveyor system (10) for a randomly disposed quantity of elongate parts (2), disposed downstream of it in the conveying direction (9) of the elongate parts (2) a first separating mechanism (11;11') for the randomly disposed elongate parts (2) and downstream of it in the conveying direction (9) of the elongate parts (2) a second separating mechanism (12; 12') for a part quantity of elongate parts (2) which may or may not have been separated, and, downstream of it in the conveying direction (9) of the elongate parts (2) a first discharge unit (13) for the separated elongate parts (2), and the separating mechanisms (11; 11'; 12; 12') each comprise at least one endlessly circulating conveyor element (47), wherein the first and/or second separating mechanism (11; 11'; 12; 12') is specifically of the type according to one of

claims 1 to 23, and a ratio of the number of elongate parts (2) in the pick-up region (39, 41; 39', 41') between the first and second separating mechanism (11, 12; 11', 12') is approximately up to 10 : 1.

26. System according to claim 25, wherein the conveyor element of the first separating mechanism (11) is formed by a conveyor belt (30) with the driver elements (31) disposed in a conveying direction (9) extending transversely to the longitudinal extension of the elongate parts (2) at a distance one after the other and directed towards the pick-up region (39) and has a width (33) corresponding to at least twice the maximum length (32) of the elongate part (2).

27. System according to claim 25, wherein a first inlet chute (25) extends between the first inlet conveyor system (10) and the first separating mechanism (11) and a second inlet chute (45) extends between the first and second separating mechanism (11, 12), and a first chute base (37) of the first inlet chute (25) is downwardly inclined in the direction towards the first separating mechanism (11) and a second chute base (49) of the second inlet chute (45) is downwardly inclined in the direction towards the second separating mechanism (12).

28. System according to claim 25, wherein the first and second separating mechanism (11; 11'; 12; 12') are disposed directly adjacent to one another in a row and the conveyor element (47) of the second separating mechanism (12') forms the concavely curved pick-up region (41'), and a discharge region (41; 51) of the first separating mechanism (11; 11'), in particular a deflection region of the conveyor belt (30) or an essentially horizontal discharge portion (87) is disposed above the pick-up region (41') of the second separating mechanism (12; 12') and projects beyond this pick-up region (41').

29. System according to claim 28, wherein the first and second separating mechanism (11; 11'; 12; 12') are disposed in a row one immediately after the other in the conveying direction (9).

30. System according to claim 28, wherein the first and second separating mechanism (11; 11'; 12; 12') are rotated by 90° with respect to one another.

31. System according to claim 25, wherein a ratio of the number of elongate parts (2) in the pick-up region (39, 41; 39', 41') between the first and second separating mechanism (11, 12; 11', 12') is up to approximately 5 : 1.

32. System (1) for conveying, separating and orienting elongate parts (2), comprising a first inlet conveyor system (10) for a randomly disposed quantity of elongate parts (2), downstream of it in the conveying direction (9) of the elongate parts (2) a first separating mechanism (11; 11') for the randomly disposed elongate parts (2) and optionally downstream of it in the conveying direction (9) of the elongate parts (2) a second separating mechanism (12; 12') for a part quantity of elongate parts (2) which may or may not have been separated, and, downstream of it in the conveying direction (9) of the elongate parts (2) a first discharge unit (13) for the separated elongate parts (2), wherein the system (1) for conveying and separating elongate parts (2) is specifically of the type according to one of claims 24 to 29, and downstream of the first discharge unit (13) in the conveying direction (9) of the elongate parts (2) is an orienting mechanism (14) for the elongate parts (2) conveyed parallel with the conveying direction (9), which has a frame (118) extending between an inlet region (125) adjacent to the first discharge unit (13) and an outlet region (126) lying opposite it in the conveying direction (9) with two parallel side frame parts (122) spaced at a distance apart from one another transversely to the conveying direction (9) and at least one driveable conveying and orienting element mounted between the side frame parts (122), which conveying and orienting element forms a shaft-type conveyor passage, the cross-sectional dimension of which becomes smaller starting form the inlet region (125) in the direction towards the outlet region (126) and which is bounded by conveyor surface portions (128) which taper in the direction towards a vertical longitudinal mid-plane (127) of the conveyor passage extending parallel between the side frame parts (122).

33. System according to claim 32, wherein the conveying and orienting element is formed by at least two endlessly circulating traction means, in particular belts, the first of which traction means is disposed in the inlet region (125) and the second of which traction means is disposed in the outlet region (126), each forming a conveyor surface (135) comprising at least two lateral conveyor surface portions (128) inclined towards one another symmetrically with respect to the longitudinal mid-plane (127) and a base-side conveyor surface portion (128) extending between them, and, as viewed in the cross-sectional plane transversely to the

conveying direction (9), the two lateral, mutually facing conveyor surface portions (128) diverge from the bottom to the top respectively at an angle of 60 ° with respect to the vertical longitudinal mid-plane (127) in the inlet region (125) and at an angle of 45 ° with respect to the longitudinal mid-plane (127) in the outlet region (126) so that the conveyor passage (124) is of an approximately trapezoid shape in cross-section and the cross-sectional dimension in the inlet region (125) is bigger than the cross-sectional dimension in the outlet region (126).

34. System according to claim 33, wherein the cross-sectional dimension is respectively constant across the length of the inlet and outlet region (125, 126).

35. System according to claim 33, wherein the base-side conveyor surface portion (128) is formed by a third traction means, in particular belt, which extends across a distance corresponding to the width between the lateral conveyor surface portions and the length of the conveyor passage (124) of trapezoidal cross-section.

36. System according to claim 32, wherein the conveying and orienting element is formed by several conveying and orienting rollers (129, 130) in the shape of an egg timer disposed in a horizontal plane spaced at a distance (131) apart from one another between the inlet and outlet region (125, 126) in the conveying direction (9) extending parallel with the longitudinal extension of the elongate part (2), which are coupled via a drive mechanism with at least one drive motor (147).

37. System according to claim 36, wherein the conveying and orienting rollers (129, 130) are mounted on the side frame parts (122) so as to be rotatable respectively about a rotation axis (133) oriented perpendicular to them and respectively have a radially extending narrow region (134) in a middle portion by reference to their longitudinal extension bounded by the conveyor surface portions (128).

38. System according to claim 37, wherein the narrow region (134) is bounded by a concave conveyor surface (135) made up of the conveyor surface portions (128) disposed symmetrically with respect to the longitudinal mid-plane (127) and is approximately U-shaped.

39. System according to claim 37, wherein the narrow region (134) is bounded by a con-

veyor surface (135) made up of at least two flat conveyor surface portions (128) inclined towards one another and disposed symmetrically with respect to the longitudinal mid-plane (127) and is of a V-shaped or trapezoidal design and the planes of two surface portions (128) lying opposite one another transversely to the conveying direction (9) of the elongate parts (2) subtend an angle (139).

40. System according to claim 38, wherein a radius (136) of the concave or arcuate conveyor surface (135) of the at least one conveying and orienting roller (129) in the inlet region (125) is approximately the same as or slightly bigger than a maximum cross-sectional dimension (34) of the elongate part (2).

41. System according to claim 38, wherein a radius (137) of the concave or arcuate conveyor surface (135) of the at least one conveying and orienting roller (130) in the outlet region (126) is smaller than a maximum cross-sectional dimension (34) of the elongate part (2).

42. System according to one of claims 36 to 41, wherein at least two conveying and orienting rollers (129) are disposed in the inlet region (125) and at least two conveying and orienting rollers (130) are disposed in the outlet region (126).

43. System according to one of claims 36 to 42, wherein an inlet roller (132) is additionally disposed upstream of the conveying and orienting roller (129) in the inlet region (125) in the conveying direction (9) of the elongate parts (2).

44. System according to one of claims 38 to 43, wherein the radius (129) of the concave conveyor surface (135) or angle (139) subtended by the two oppositely lying conveyor surface portions (128) of the conveying and orienting roller (129) in the inlet region is bigger than the radius (130) or angle (139) of the conveying and orienting rollers (130) disposed in the outlet region (126) so that the cross-sectional dimension of the conveyor passage (124) in the inlet region (125) is bigger than the cross-sectional dimension in the outlet region (125).

45. System according to one of claims 36 to 44, wherein the conveying and orienting rollers (129) in the inlet region (125) are each of the same radius (136) or angle (139) and the conveying and orienting rollers (130) in the outlet region (126) are reach of the same radius

(137) or angle (139) so that the cross-sectional dimension of the conveyor passage (124) respectively remains continuously constant across the entire length of the inlet and outlet region (126).

46. System according to one of claims 36 to 45, wherein a longitudinal distance (141) between a rotation axis (133) of the inlet roller (132) disposed upstream of the first conveying and orienting roller (129) in the inlet region (125) in the conveying direction (9) of the elongate part (2) and a rotation axis (133) of the last conveying and orienting roller (130) in the outlet region (126) in the conveying direction (9) of the elongate part (2) approximately corresponds to the maximum length (32) of the elongate part (2).

47. System according to one of claims 36 to 46, wherein at least one deflector element (142) is disposed between two consecutive conveying, orienting and inlet rollers (129, 130, 132), which has a deflector surface (143) more or less conforming to the contour of the narrow region (134) and disposed slightly below the conveyor surface (135).

48. System according to one of claims 36 to 44, wherein the conveying, orienting and inlet rollers (129, 130, 132) of the orienting mechanism (14) are disposed separately at a slight distance (131) from one another in a row in the conveying direction (9) and are mounted on two vertically upright side frame parts (122) so as to be rotatable about the rotation axes (133) extending perpendicular thereto and the orienting mechanism (14) comprises a drives mechanism, in particular a toothed gear or traction means gear, and a drive motor (147), and the conveying, orienting and inlet rollers (129, 130, 132) are coupled via the drive mechanism with the drive motor (147).

49. System according to claim 32, wherein a second discharge unit (15) is disposed downstream of the orienting mechanism (14) in the conveying direction (9) of the elongate parts (2), which has a separating system for incorrectly oriented or damaged elongate parts (2), which separating system has an image-processing camera system (153), in particular a CCD scanner camera, and a gating-out unit.